Speaking generally, it may be said that the cartilaginous glottis is generally open in the lower and gently closed in the upper notes of the chest, and that a segment of the ligamentous glottis is *tightly* closed in the head voice. The two registers may be called the long-reed and the short-reed, according to the length of the cord vibrating. It has also been noticed that the blast of air is much feebler with the head than with the chest voice.

The new and important observation which Dr. Mackenzie has made and amply verified is, that in the head note of women and in falsetto singing only the anterior third of the vocal cords, as shown in Figs. 3 and 4, vibrate, and that the remainder of the cords are in firm contact with one another. Only twice has he observed a vibration limited to the middle third of the cords, which has often been described as the usual one. Some observers have asserted that in falsetto only the extreme edge of the cords vibrates; but, as 12 inches is the nearest distance at which a good image can be obtained by the laryngoscope, only the mean position of the cords can be observed, and it is impossible to detect any vibration when a high note is being sung; and hence the author rejects the statements of those who profess to have observed vibrations limited to the edge.

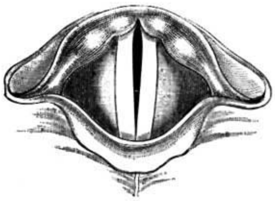

FIG. 1.—The position of the vocal cords for the lower range of chest notes.

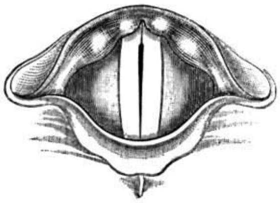

FIG. 2.—The position of the vocal cords for the higher range of chest notes

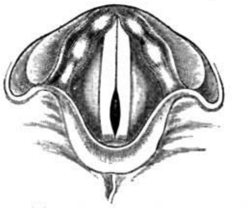

FIG. 3 —The position of the vocal cords for head notes.

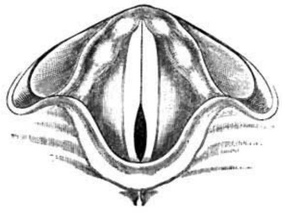

FIG. 4.—The position of the vocal cords for falsetto notes.

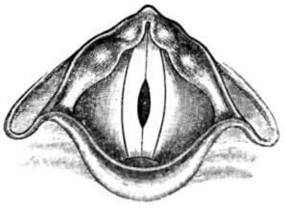

FIG. 5.—A very exceptional position of the vocal cords for head notes.

The long-reed or chest voice is generally used by sopranos, Figs. 1 and 2 showing the position of the cords in the case of Mesdames Nilsson, Albani, and Valleria; on the other hand, the high notes of mezzo-sopranos and contraltos are short-reed, *e.g.* Madame Patey, as shown in Fig. 3. Tenors use both reeds, while the long only is used by the basses, and commonly by the barytones.

Alto singers among men use the short-reed, whilst boys always use the long.

In falsetto the false vocal cords, which are movable bands of tissue superior to the true vocal cords, also approximate considerably.

The quality of a voice depends upon the accuracy with which the vocal cords are moved, on their tension, on the regulation of the respiration, on the position of the soft palate and fauces, and on the movements of the tongue and lips.

These points are all touched upon, but the details of the methods by which they are to be trained do not fall within the scope of this book, but belong to the domain of the singing-master.

A certain amount of vocal discipline is recommended for children as early as the age of five or six, or even younger, but it should be limited to simple airs of limited compass, such as those by Louisa Gray, published by Messrs. Wood and Co. They are warranted to contain "no love and no high notes," and may therefore be trusted not to inflame either the infant's tender heart or its delicate larynx.

Observations on 500 choristers have disproved the idea that "cracking" or "breaking" of the voice is an essential stage, for in only 17 per cent. did the voice become cracked in changing to the adult condition; and in these cases the cords were congested, and the state was due to over-exertion or to cold.

The hygiene recommended for vocalists may be summed up in the adoption of such a mode of life as is most beneficial to the general health; prompt treatment of any cold or hoarseness; and, if their faith is pinned on the virtues of raw eggs, champagne, or any of the thousand and one things recommended for the voice, they may be permitted, if they are not absolutely injurious.

The latter part of the book is occupied with the training of the speaking voice, an account of its various defects, and the methods of diminishing them.

Stammering, which depends on a defective control over the respiration and over the tension of the vocal cords, may be much improved by training; while stuttering, which depends on a spasm of the tongue and on imperfect control over the lips, is rarely benefited, except in the slighter cases. Strychnine is occasionally of use, while tobacco intensifies the difficulty.

Valuable hints for training the voice are given, and great stress is laid on the importance of a most accurate acquirement of the vowel sounds, when the consonantal follow readily.

A NEW CASE OF PARTHENOGENESIS IN THE VEGETABLE KINGDOM

EIGHT years ago I discovered in the *Quebrada* (*i.e.* ravine) of Guarenas, about nine miles to the east of Caracas, and approximately at 650 metres above the level of the sea, one of those charming groups of tropical vegetation, which are equally interesting to the botanist and to the lover of the picturesque beauties of nature. A magnificent specimen of *Pogonopus Ottonis* was all aglow with its large rosy sepals; up to its highest branches a luxuriant *Vitis caribæa* had ascended in graceful festoons, laden with blackish grapes, and displaying now and then in the gentle breeze the silvery glimmer from the under side of its palmate leaves; whilst in the damp shade underneath throve a colony of *Gloxinia pallidiflora*, a plant which from its bruised leaves gives out a smell identical with that of the spearmint.

My attention, however, was especially attracted to a tall suffrutescent climber with dark-green ivy-like foliage, and large drooping clusters of bright-red fruits, which I was sure I had never met with before. The general *facies* was certainly that of a menispermaceous plant; but the structure of the fruit proved to be utterly discrepant from anything I knew of this family. Flowers I found none, and a prolonged search in the neighbourhood for another specimen was to no effect. I gathered a quantity of fruits, some of which were sown in the little garden belonging to the house I inhabited at the time in Caracas. Others I sent to several leading botanists in Europe, requesting them to give me their opinion about the plant; the result, however, was negative, the fruit being to all of them a puzzle, just as it had been to myself.

Meanwhile some of the seeds had germinated; I planted out three seedlings, which grew very vigorously, and in time produced an abundance of flowers, *all female ones*. Their structure gave additional weight to the supposition that the plant belonged to the Menispermaceæ, and believing it to be a new genus, I was anxious to discover the male plant. In this pursuit the botanical interest went hand in hand with that of the horticulturist; for although the plant is highly ornamental on account of its foliage, its principal merit as a decoration in a tropical garden consists in the striking contrast between the dark-green leaves and the large number of scarlet fruits, which bear the greatest resemblance to the half-ripe berries of the coffee-tree.

For a long time all my efforts were unsuccessful. I had moreover occasion to convince myself that the plant was extremely rare in our flora, as only in two places of the above-mentioned ravine a few specimens hitherto have been found by myself and my collectors.[1]

In 1881 at last one of my men brought me a plant which he pronounced to be a male one. The plant was set between two female ones, and after a couple of months I had the great satisfaction of beholding for the first time the *male* flowers that for several years had been the object of many a fatiguing search in the dense thickets of the little river of Guarenas. Both female plants produced now a large crop of fruits, though I was unable to make out by what agency the transport of pollen was effected. Of animals I noticed on the plants only a small species of a green *Tettigonia* (rather plentiful), some common mosquitoes, and a few caterpillars of *Ophideres cacica*.[2] It is not impossible that the mosquitoes were of some significance for the purpose of fecundation. I thought once the flowers might be of the anemophilous type; but this is certainly a mistake, as they are so much hidden amongst the foliage that the wind can hardly reach them.

I sent male and female flowers, as well as fruits, to Kew, and following the advice of Sir J. D. Hooker, likewise to Prof. Eichler, of Berlin, who recognised the plant as belonging to his genus *Disciphania*, and described it afterwards under the name of *Disciphania Ernstii* in *Jahrbuch des Kön. Botan. Gart. zu Berlin*, vol. ii., 1883, pp. 324-29, giving at the same time the analytical details of the flowers and fruit on Plate XII. of the volume referred to. As this work may not be easily accessible to all who take an interest in the facts I have to present hereafter, I deem it convenient to insert a summary description of the species, giving, however, a fuller development to certain structural particulars which, in my opinion, possibly may have some bearing upon the chief point of my communication.

Like many other Menispermaceæ, *Disciphania* bears root-tubers, which are, in good-sized plants, as large as a man's fist, and weigh 1 lb. and even more. They contain a considerable quantity of ovoid starch grains, the largest measuring 0·04 by 0·026 millim. The stem exhibits the compound structure usually found in climbing plants; it soon becomes woody in its lower part, whilst at the same time the periderm increases greatly in thickness, and forms a very irregular spongy bark. The younger parts of the stem, as well as the branches, generally wind around any support they may encounter; but sometimes they climb by means of the petioles, the basal part of which is rather abruptly thickened and variously curved, so that it serves as a hook, more or less, as in some species of *Clematis*. There are other branches which do not climb at all, but either hang down without showing any sign of torsion, or run in a straight line on the soil. The cortical system is very much developed, and the central parenchyma abounds in laticiferous cells, each one containing a great many nuclei and a viscid latex.

The leaves are most singularly polymorphous on the same plant, as will be seen from Figs. 12 to 16, which are copied, as likewise all the others, from Prof. Eichler's plate. The palmatisect leaf (Fig. 16) exhibits the basal thickening and inflection of the petiole, which I mentioned before.

The flowers are strictly diœcious, and in both sexes arranged in axillary, centripetal, and drooping spikes, measuring from 8 to 25 centimetres in length. The rachis of the female spikes is very thin at the basal end, where it is scarcely 1 millimetre thick; but it increases gradually in thickness, and in many cases it measures at the opposite end 3 millimetres by 2, so that the extreme transverse sections are in the ratio of 1 to 6 approximately. Its tissue is gorged with latex, especially in the thicker part, which has an appearance as if it were due to a kind of normal hypertrophy. Not having actually any fresh male inflorescences, I am unable to say whether their rachis presents the same structure; amongst my old notes I cannot find anything referring to it.

The flowers are so crowded that they touch each other, and hide the rachis and their little bracts completely. This is especially the case towards the apex of the spikes, where not unfrequently two or three empty bracts are found, undoubtedly indications of as many suppressed or aborted flowers. Figs. 1 to 3 represent the male flower; Figs. 4 to 7 the female one. Both have six large sepals and six very small petals; in the former there are three stamens, in the latter three pistils, but in none the slightest rudiment of the organs of the other sex is to be seen. I have carefully examined hundreds of female flowers, and can most positively assert that this rule holds good in every case, nor are there on the female plants any rudimentary male flowers, auxiliary stamens, or any other contrivances that could be considered as pollen-producing organs.

Fig. 8 represents an almost full-grown fruit in its natural size; Fig. 9 is the seed, viewed from the flat side, magnified 25 times; Fig. 10 is its longitudinal section, with the straight embryo *in situ*; and Fig. 11 is a transverse section of the same. The very peculiar wings of the seed develop gradually, as indicated by the letters *a*, *b*, and *c*, in the last-mentioned figure.

I have thought it necessary to give a rather lengthy exposition of introductory matter, before entering upon the principal object of the present paper. The question of parthenogenesis in the vegetable kingdom is still strenuously objected to by many botanists, although it is a thoroughly well-established fact in the domain of zoological science, so that there is *a priori* really no reason for denying its existence in plants. It is, however, of the greatest importance to give in any particular case a most substantial and complete record of the leading facts, as well as of the concurrent circumstances, so as to enable the reader to get a full view of the matter, and form his own judgment accordingly. I hope to do the second, as far as it is pertinent, and shall now proceed to relate my observations on, and experiments with, *Disciphania Ernstii*, from which I have come to the conclusion that in this species we have really *a new case of parthenogenesis in the vegetable kingdom*.

Long before I got the male plant of *Disciphania*, I had noticed that on my female plants appeared now and then a few fruits. Very naturally the idea crossed my mind that I might have before me a case of accidental parthenogenesis; I was, however, too much interested in obtaining, first, the missing sex, in order to make sure what species of plant was the subject of my researches.

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[1] It is a singular coincidence that in one of these places another very curious Menispermacea was found, viz. a female plant of *Odontocarya hederæfolia*, Miers.

[2] The caterpillar and pupa of this beautiful moth were on this occasion described for the first time. See a note, "Jugendstadien von *Ophideres cacica*," in Karsch, *Entomologische Nachrichten*, 1885, pp. 6, 7.

In December 1881 I removed to another house, but before doing so I totally destroyed all my specimens of *Disciphania*, as I wished to begin my further investigations on two young plants which had not yet flowered. These I procured early in 1882, and, most fortunately, both proved to be females. I had some lattice-work placed against the wall of an inner court-yard, and there the plants were left to over-run the whole wall, which is 4·5 metres by 4. As soon as the flowers

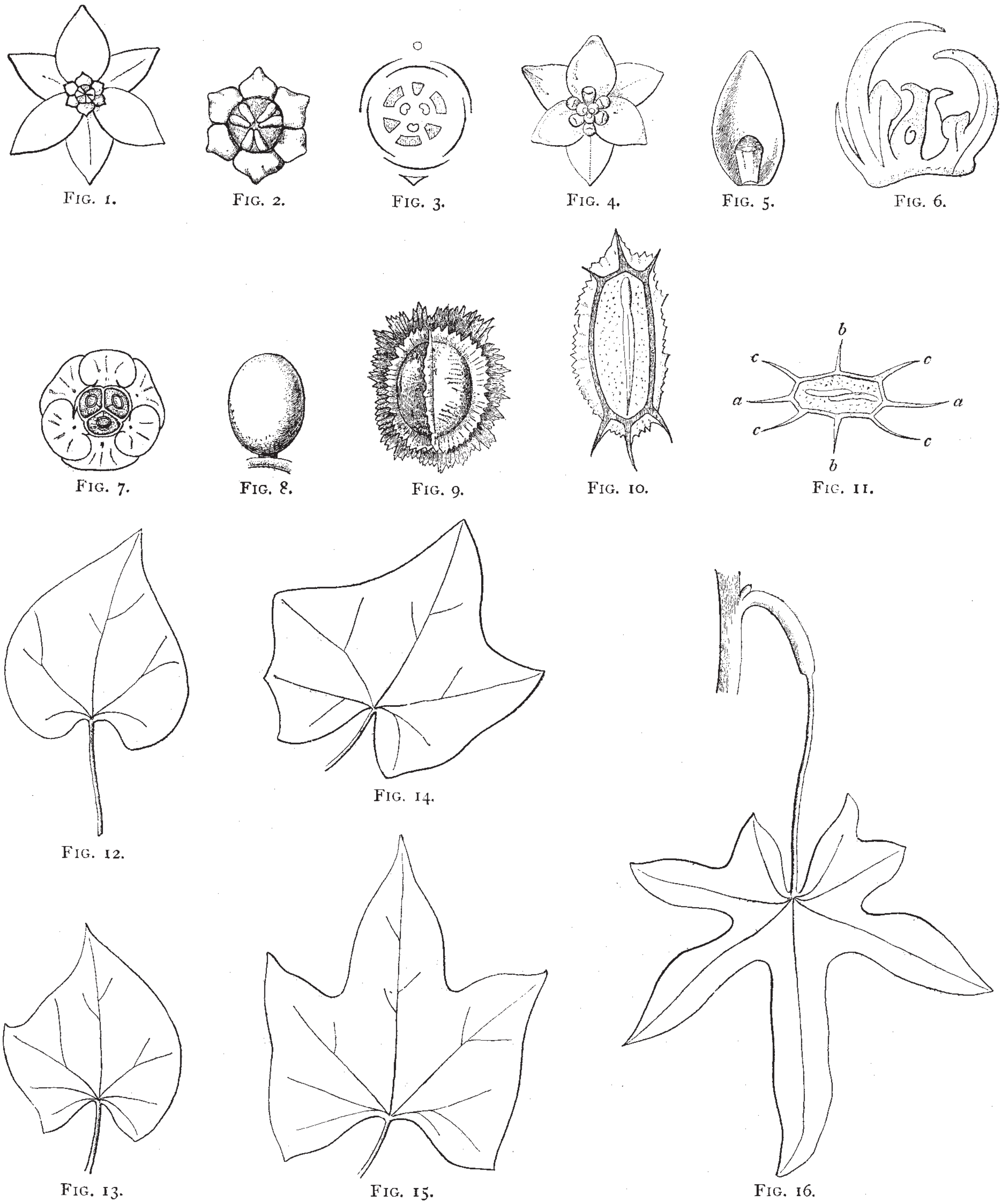

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11.

Fig. 12. Fig. 14.

Fig. 13. Fig. 15. Fig. 16.

Disciphania Ernstii, Eichl. (After Eichler.)

appeared I proceeded to examine them as carefully as possible, in order to see whether there were any male organs concealed either within or in their neighbourhood, but I searched in vain. In March 1883 the plants had covered the whole space allotted to them, and were then cut down. Branch after branch was once more submitted to the closest inspection, and the existing fruits, numbering 20, were collected. Of these 20 fruits I examined 5, and found that 3 had perfect embryos; 10 were sown in pots, but only 3 germinated; the remainder of the crop I still have in my carpological collection.

The plants soon began to sprout anew, and were again carefully searched whenever time and weather would allow it. They were cut off in December 1884, giving a crop of 54 fruits, which were disposed of in the following manner:—Examined, 10, 7 having perfect embryos; sown, 20; germinated, 9; kept in salt solution, 24.

The third period lasted till February 1886. Both plants were very vigorous, and had produced a large number of flowers, so that I collected no fewer than 137 fruits, of which 10 were examined (5 were good), 20 were sown, (8 germinated, the young plant being now about 6 inches high); the remainder will be sent to different botanical gardens within the tropics, in order that my experiments and observations may be repeated under the most favourable circumstances possible.

Since February the plants have grown a good deal; one is flowering and has already four fruits.

From the very outset of my observations I had noticed that these fruits appeared only on the thickened end of the flowering rachis, which is always the lowest part of the pendent inflorescence, as I have described in the first section of this paper. I cannot help thinking that this circumstance has something to do with the production of these fruits in general.

I must observe that the numbers 20, 54, and 137 of the fruits collected are not the total numbers of fruits produced by the plants in each period; for the earlier fruits fell off and got lost long before I gathered the crop. Whatever may have been this loss, it is certain that there was a constant and very notable increase of fruits. I am sorry I omitted counting all the flowering spikes at the time when the plant were cut down, so as to be able to compare their number with that of those bearing fruits, and to find out, at least approximately, whether both groups of numbers were reciprocally proportionate, or not so.

Be this as it may, *there is no denying the fact that many female plants produced in three successive years an increasing number of fertile fruits without the operation of any fertilising pollen from a male flower.*

The reader will remember that the nearest group of *Disciphania* is at a distance of about nine miles from Caracas. I am quite positive about this point, being well acquainted with the vegetation in the environs of the city. Now it is incredible that under such circumstances and in this species, which has neither showy flowers nor any perceptible smell, the pollination could have been effected by insects. It is furthermore certain that my plants of *Disciphania* are the *only* ones in Caracas, and that for this reason there is no specimen nearer to them than the few spontaneous ones which may grow in the ravine of Guarenas.[1] And even if there had been any pollination from outside, how is it that plants, which are known to be extremely prolific under normal circumstances, should produce such very scanty crops, although grown under the most favourable conditions?

For these different reasons I hold that the possibility of pollination from a male plant is entirely out of the question, and may fairly be discarded.

But it is likewise impossible that pollination could have taken place with material produced by the plants themselves, as no rudimentary male flowers, nor auxiliary stamens, have been discovered on them during the most scrutinising search in three successive years; nor was there ever found one single grain of pollen on the hundreds of stigmas that were inspected in the course of this investigation. I well remembered Karsten's criticism of Alexander Braun's paper on parthenogenesis in *Cœlebogyne*, and was, accordingly, very scrupulous to establish beyond all question the absence of any pollen-producing organs. I am fully convinced that I should have found them, if any had really existed.

In another respect I was unable to arrive at a positive result. I could not make sure whether the embryo is developed as an outgrowth from a cell of the nucellus, as Strasburger has found in *Cœlebogyne*, or whether it is the development of an unfertilised oosphere. As, however, the former case appears to be always connected with polyembryony, which does not occur in the seeds of *Disciphania*, it seems to me more probable that in this plant we have an instance of the second case, or of true parthenogenesis, certainly not as the rule and normal *modus* of reproduction, but as an exception, and a very rare one, a kind of makeshift of nature, as it were, when the co-operation of the fertilising material cannot be realised.

In Prof. Weismann's essay, "The Continuity of the Germ-Plasma," there is a chapter on the nature of parthenogenesis, which abounds in suggestions which, in my opinion, throw much light on the case under consideration. I quote the following sentence from Prof. Moseley's abstract in NATURE, vol. xxxiii. p. 157:—"If a special supply of nourishment reaches the germ-plasma, this increases in amount by growth, and thus obtains the mass requisite to start the ontogenetic process, with the result that parthenogenetical development takes place." Strasburger had already pointed out that an analogous result may be arrived at by specially favourable conditions in the supply of food, which counteracts the insufficiency of the germ-plasma. May we not suppose that something similar happens in *Disciphania?* Besides the herbaceous branches, the club-shaped rachis of the spicate inflorescences abound in proteids, and consequently there must be a specially abundant supply of food, which may have some particular influence on the growth of the ovary and its contents. And it is on those places we find precisely the fruits for which I claim a parthenogenetic origin.

Caracas, June 7 A. ERNST

P.S.—Since the foregoing article was sent to England, I have made the following observation, which, I think, gives additional strength to my view as to the probable cause of parthenogenesis in the case under consideration. On one of my plants I had noticed two rather short inflorescences (4 and 5 centimetres long), with but 3 and 4 flowers respectively, *but having a very much thickened, almost club-shaped, rachis,* which measured at the apex nearly 3 millimetres each way. The idea struck me that on these spikes very likely some fruits would appear, and I marked them out for the sake of further inspection. *My anticipations have been fully realised,* as on each of the two there is now one ovary increasing in size, measuring already 3 millimetres by 2, so that there is every reason to expect their final development.

At the same time I may mention that on the second plant, which has just begun to flower, I have found on one spike a *tetramerous,* and on another a *pentamerous,* female flower; both spikes were very small, and had only two flowers. A. ERNST

Caracas, June 23

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[1] It is interesting that the second species of *Disciphania* (*D. lobata*, Eichl.) appears likewise to be an exceedingly rare plant, as may be inferred from an observation of of Prof. Eichler's, in the article mentioned before.

OUR ENGLISH TEMPERATURES

A PERIOD of warm weather, lasting for three weeks, set in over the whole of the United Kingdom about August 24, and continued until September 14, over nearly